

2004 GALVESTON BAY INVASIVE SPECIES RISK ASSESSMENT  
INVASIVE SPECIES SUMMARY

Created by: Environmental Institute of Houston, University of Houston-Clear Lake  
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<b>Common Name:</b> Northern pike
<b>Latin Name:</b> <i>Esox lucius</i>
<b>Category:</b> Aquatic Animal
<b>Place of Origin:</b> “Atlantic, Arctic, Pacific, Great Lakes, and Mississippi River basins from Labrador to Alaska and south to Pennsylvania, Missouri, and Nebraska (Page and Burr 1991) (USGS Nonindigenous Aquatic Species Profiles).”
<b>Place of Introduction:</b> “This species has been intentionally stocked as a sport fish in most areas. In some cases, introductions were illegal, and these include such sites as Coeur d'Alene Lake, Idaho; Keyhole Reservoir, Wyoming; and Beaver Creek Reservoir, Bitterroot River, and Flathead River, Montana (McMahon and Bennett 1996), and lakes in Alaska (Bell, personal communication). McMahon and Bennett (1996) gave a table of western reservoirs with introduced populations and the method of introduction for each one. First stocked in Arizona in 1967 (Rinne 1995). In addition to being stocked as a sport fish, Pflieger (1997) stated that <i>Esox lucius</i> was stocked in Missouri reservoirs to introduce a large predator that could more effectively prey on the large populations of carp and gizzard shad present in such artificial environments ( <a href="http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html">http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html</a> ).”
<b>Date of Introduction:</b> Numerous (beginning in the 1800s) in different localities over the years ( <a href="http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html">http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html</a> ).
<b>Life History:</b> “Spawn just after ice thaws; Adhesive eggs simply scattered over the bottom or onto vegetation ( <a href="http://www.gf.state.az.us/frames/fishwild/idx_fish.htm">http://www.gf.state.az.us/frames/fishwild/idx_fish.htm</a> ).”  “Most males and females reach sexual maturity at two to five years (Werner, 1980). Northern Pike reproduction period generally extends from March to May, depending on the water temperature and duration of ice cover.  In spring the fish congregate in shallow marshy areas often in inlets of small streams, as is characteristic of Grindstone Creek. Here the female deposits her eggs in daylight over the vegetated bottom, up to 100,000 eggs. Accompanying males fertilize the eggs. The unguarded eggs hatch in about two weeks (Werner, 1980) and the young feed upon tiny aquatic life in the nursery area for about a month, after which they move to deeper waters ( <a href="http://www.science.mcmaster.ca/Biology/Harbour/SPECIES/PIKE/PIKE.HTM">http://www.science.mcmaster.ca/Biology/Harbour/SPECIES/PIKE/PIKE.HTM</a> ).”
<b>Growth/Size:</b> 133 cm.
<b>Feeding Habits/Diet:</b> “Fish make up the bulk of their diet but they will also take frogs, crayfish, waterdogs, ducks, birds, and mice ( <a href="http://www.gf.state.az.us/frames/fishwild/idx_fish.htm">http://www.gf.state.az.us/frames/fishwild/idx_fish.htm</a> ).”
<b>Habitat:</b> “Prefer shallow water and areas congested with aquatic weeds ( <a href="http://www.gf.state.az.us/frames/fishwild/idx_fish.htm">http://www.gf.state.az.us/frames/fishwild/idx_fish.htm</a> ).”  “In their natural Canadian Range in and near the Great Lakes, their preferred habitat changes with the seasons and water temperature. Northern pike are generally found in shallow, weedy areas during spring spawning and early summer. However later in the summer, they move into deeper and more open water where they generally remain during the fall and winter ( <a href="http://www.science.mcmaster.ca/Biology/Harbour/SPECIES/PIKE/HABITAT.HTM">http://www.science.mcmaster.ca/Biology/Harbour/SPECIES/PIKE/HABITAT.HTM</a> ).”
<b>Attitude (aggressive, etc.):</b> “The piscivorous northern pike has been shown to significantly reduce prey density and has the potential to cause large-scale changes in fish communities, even resulting in species elimination (He and Kitchell 1990) ( <a href="http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html">http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html</a> ).”
<b>Physical Description:</b> “Back and sides, dusky olive-green with rows of light oval spots. Dorsal, anal and tail fin have round to oblong darkened spots. Dorsal fin located far back on an elongated body. Large canine-like teeth. Cheeks completely scaled, only upper half of the gill cover is scaled ( <a href="http://www.gf.state.az.us/frames/fishwild/idx_fish.htm">http://www.gf.state.az.us/frames/fishwild/idx_fish.htm</a> ).”
<b>Management Recommendations / Control Strategies:</b> include references for existing site-specific strategies  Save Lake Davis Task Force Steering Committee; The California Department of Fish and Game. 2000. Managing Northern Pike at Lake Davis: A Plan for Y2000. January <a href="http://www.dfg.ca.gov/northernpike/mgpike.htm">http://www.dfg.ca.gov/northernpike/mgpike.htm</a> ”Managing Northern Pike at Lake Davis: A Plan for Y2000 describes 12 recommended containment and control actions to be implemented during 2000 as a way to manage the pike problem at Lake Davis. The plan also describes the monitoring program that would be undertaken in order to measure the plan's success and provide opportunities to make informed course corrections should they be needed. While the plan has been designed to be non-technical and readily understood by a broad audience, it does contain

selected references in order to provide more detailed background information for those who desire it. Two appendices are also included in the report: the Steering Committee's preliminary feasibility analysis of alternatives, and a brief review of the life history and biology of the northern pike.

The primary strategies outlined in this plan for Y2000 are: 1) To suppress the pike population at Lake Davis; 2) To contain the existing population in Lake Davis and prevent it from spreading into other parts of the state's waterways; and 3) To remove as many pike of all sizes from Lake Davis as possible using a combination of various activities, with implementation concentrated on the spawning season.

In order to control northern pike at Lake Davis and prevent a population explosion, the number of spawning-sized fish should be kept as low as possible and a high percentage of the larval fish produced by successful spawning should be eliminated. These objectives have guided the selection of the control and containment measures recommended in this report. Treatment of the lake with formulated rotenone (rotenone with agents added to aid dispersion) and other chemicals prohibited by Proposition 65 are excluded from this plan at the instruction of the Director of the Department of Fish and Game. The plan instead concentrates on a variety of physical methods, which provide barriers to pike or offer means of destroying pike individually or in groups. Of the physical methods identified for use, a combination of barrier nets, electrofishing and detonation cord (widely used to remove unwanted fish of all sizes by underwater concussion) employed at the right time likely offers the best potential for success.

The primary strategy to suppress and/or remove the pike population in Y2000 relies on an experimental approach that combines a number of different actions concentrated during the spawning season. In addition, a number of other individual physical measures should be used, based on the belief that their cumulative effect would be effective in reaching the plan's management goals for Lake Davis. The plan also calls for increased enforcement, a public education program, and an extensive biological monitoring program.

#### Summary of Key Y2000 Operational Plan Components

The full report describes 13 different management activities that are recommended for management of the pike problem at Lake Davis. In brief, these activities include:

1. Use of experimental control measures involving the use of net barriers, electrofishing, detonation cord and encircling nets in combination with other management activities. Barrier nets could be used to contain numbers of adult, juvenile and larval pike for removal by electrofishing and by concussion from detonation cord during spring and early summer. This combination appears to provide the greatest potential for controlling pike at Lake Davis;
2. The installation of tributary barriers. Physical barriers could be placed in the tributaries to Lake Davis during spring thaw to prevent spawning and the establishment of stream populations of pike;
3. Blocking spawning areas. At spring thaw, block nets could be used to trap spawning pike in portions of the Lake for elimination;
4. Reducing pike food supplies and stock brown trout as a predator species. The Department could discontinue stocking fingerling trout, a prey source for pike, and plant only larger catchable-sized trout. Brown trout should be included in those plants to increase predation on smaller pike;
5. Encourage pike fishing in ways (including derbies) that do not promote angler interest in pike. Depending on the status of the pike population, the Department may assist the local community in holding organized fishing events to remove pike from Lake Davis;
6. Use drag nets and purse seines (encircling nets). Following spring thaw, various nets can be fished for adult and juvenile pike to additively reduce the pike population;
7. Increase the use of electrofishing, particularly in the spring. Following spring "ice out" and continuing on to fall, electrofishing gear could be used to remove pike from Lake Davis and its tributaries;
8. Use electrofishing to herd pike toward traps and nets. On a monthly basis, an electrofishing boat could be used to drive pike into nets for removal;
9. Take various actions relating to the Dam including: 1) Installation of an upstream containment barrier; 2) Installation of an electric barrier; 3) Modification of the discharge orifice; 4) Maintenance of the lake level to avoid a spill; and 5) Retain the fish grate at the outflow wall. In addition to the fish grate currently used, various devices - electrical barrier, aquatic exclusion system and deep water discharge orifice - could be deployed at the Grizzly Valley Dam to contain northern pike in Lake Davis;
10. Use fyke nets and trap nets. Following "ice out," fyke and trap nets can be set at various locations around Lake Davis to remove pike on an additive basis;
11. Increase enforcement activities. The Department will increase its enforcement efforts to contain pike in Lake Davis and improve its ability to use DNA analysis as a tool of enforcement;
12. Improve public education. The Department will substantially increase its public information efforts to motivate citizens to help contain and control pike in Lake Davis; and
13. Initiative a comprehensive fish monitoring program. Systematic sampling efforts conducted since May 1999 to monitor the

pike population at Lake Davis should be repeated in 2000. This would provide an index of abundance of pike and other fish species and measure the success of any control and containment efforts.

The relative effectiveness of the proposed control and containment efforts would be assessed through an extensive monitoring program. The systematic sampling program conducted in 1999 would be replicated in 2000 to provide a numerical index of the number of pike and other fishes and a measure of the success of the program. This information would be gathered through the use of electrofishing, gill nets and box traps.

Looking to the future, those working on the pike problem must continue to employ an adaptive approach that is responsive to changes, new information and new approaches. In the coming months, it is anticipated that the Task Force and Coalition will continue their discussions and work. In addition, the Department and other government agencies plan to take any steps necessary to comply with the various permitting and environment review requirements that govern the project. New information gained through monitoring and other studies at Lake Davis, as well as from new developments in fisheries management, will be folded into the effort.

The Department of Fish and Game plans to continue its collaboration with the community as the plan progresses and the results of the effort are measured.”

The California Department of Fish and Game. 2002. Use of Detonation Cord in Lake Davis to Control Population of Northern Pike Initial Study and Proposed Mitigated Negative Declaration. January. [http://www.dfg.ca.gov/northernpike/det\\_cord\\_final\\_doc.html](http://www.dfg.ca.gov/northernpike/det_cord_final_doc.html)

The California Department of Fish and Game. 2002. Use of Detonation Cord in Lake Davis to Control Population of Northern Pike Initial Study and Proposed Mitigated Negative Declaration. Appendix A. Impact of Detonation Cord on Northern Pike (*Esox lucius*) and Aquatic Life. [http://www.dfg.ca.gov/northernpike/det\\_cord\\_appendix\\_a.html](http://www.dfg.ca.gov/northernpike/det_cord_appendix_a.html). Accessed December 30, 2002. Examines the impacts of explosives and detonation cord on Northern pike in Lake Davis, California.

#### **References (includes journals, agency/university reports, and internet links):**

1. [http://nas.er.usgs.gov/fishes/accounts/esocidae/es\\_luciu.html](http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html). USGS Nonindigenous Aquatic Species Profiles.
2. <http://www.dfg.ca.gov/northernpike/mgpike.htm>. Save Lake Davis Task Force Steering Committee; The California Department of Fish and Game. 2000. Managing Northern Pike at Lake Davis: A Plan for Y2000. January
3. <http://www.dfg.ca.gov/northernpike/index.html>. California Department of Fish and Game Lake Davis Northern Pike Web Page.
4. [http://www.gf.state.az.us/frames/fishwild/idx\\_fish.htm](http://www.gf.state.az.us/frames/fishwild/idx_fish.htm). Arizona Game and Fish. Species Descriptions.
5. <http://www.science.mcmaster.ca/Biology/Harbour/SPECIES/PIKE/PIKE.HTM>. Werner, Robert. G. 1980. *Freshwater Fishes of New York State*. Wooding, Frederick H. 1959. *The Book of Canadian Fishes*. McGraw-Hill Ryerson Limited, Toronto.
6. McMahon, T. E., and D. H. Bennett. 1996. Walleye and northern pike: boost or bane to northwest fisheries? *Fisheries* 21(8):6-13.
7. Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. The Peterson Field Guide Series, volume 42. Houghton Mifflin Company, Boston, MA.
8. Rinne, J. N. 1994. The effects of introduced fishes on native fishes: Arizona, southwestern United States. World fisheries congress, May 1992, Athens, Greece.
9. Pflieger, W. L. 1997. The fishes of Missouri. Missouri Department of Conservation, Jefferson City, MO. 372 pp.
10. He, X., and J. F. Kitchell. 1990. Direct and indirect effects of predation on a fish community: a whole lake experiment. *Transactions of the American Fisheries Society* 119:825-835.
11. The California Department of Fish and Game. 2002. Use of Detonation Cord in Lake Davis to Control Population of Northern Pike Initial Study and Proposed Mitigated Negative Declaration. January. [http://www.dfg.ca.gov/northernpike/det\\_cord\\_final\\_doc.html](http://www.dfg.ca.gov/northernpike/det_cord_final_doc.html)
12. The California Department of Fish and Game. 2002. Use of Detonation Cord in Lake Davis to Control Population of Northern Pike Initial Study and Proposed Mitigated Negative Declaration. Appendix A. Impact of Detonation Cord on Northern Pike (*Esox lucius*) and Aquatic Life. [http://www.dfg.ca.gov/northernpike/det\\_cord\\_appendix\\_a.html](http://www.dfg.ca.gov/northernpike/det_cord_appendix_a.html). Accessed December 30, 2002. Examines the impacts of explosives and detonation cord on Northern pike in Lake Davis, California.

#### **Available Mapping Information:**

1. Crossman (1978) gave a distribution map. See USGS Nonindigenous Aquatic Species Profiles. [http://nas.er.usgs.gov/fishes/accounts/esocidae/es\\_luciu.html](http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html) for this reference.
2. USGS Nonindigenous Aquatic Species Profiles. [http://nas.er.usgs.gov/fishes/accounts/esocidae/es\\_luciu.html](http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html)
3. McMahon and Bennett (1996) gave a map showing introduced populations in the northwest. McMahon, T. E., and D. H. Bennett. 1996. Walleye and northern pike: boost or bane to northwest fisheries? *Fisheries* 21(8):6-13.
4. Tyus et al. (1982) gave a distribution map of this species in the upper Colorado basin. See USGS Nonindigenous Aquatic Species Profiles. [http://nas.er.usgs.gov/fishes/accounts/esocidae/es\\_luciu.html](http://nas.er.usgs.gov/fishes/accounts/esocidae/es_luciu.html) for this reference.